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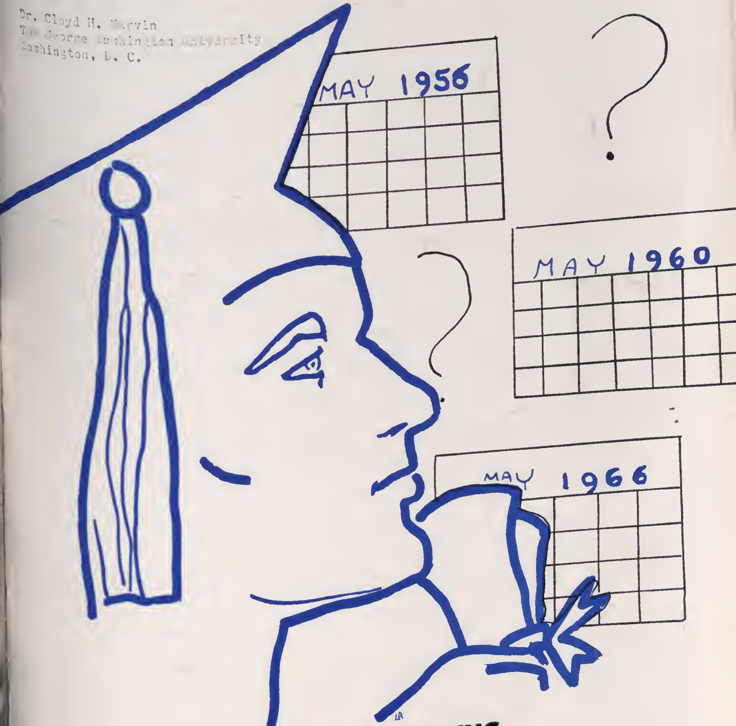
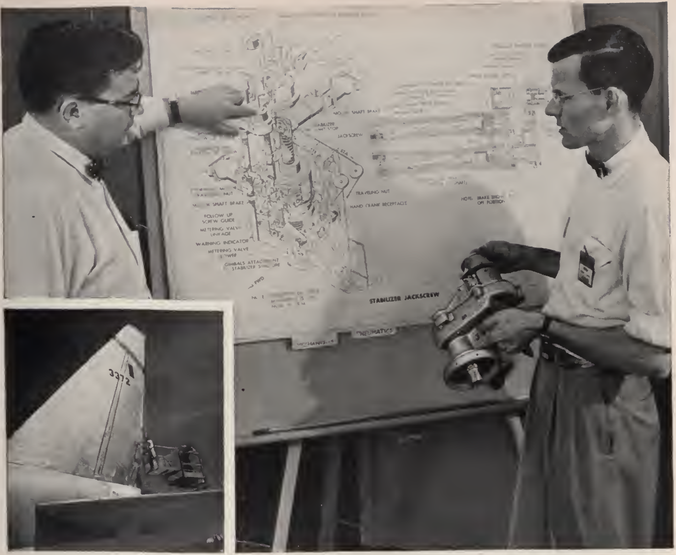
Mecheleciv

VOL. 15 NO. 6



SCHOOL OF ENGINEERING
THE GEORGE WASHINGTON UNIVERSITY

MAY 1956



B-52 jack screw—a typical Boeing design challenge

On Boeing B-52 bombers, the horizontal tail surface has more area than the wing of a standard twin-engine airliner. Yet it can be moved in flight, up or down, to trim the aircraft.

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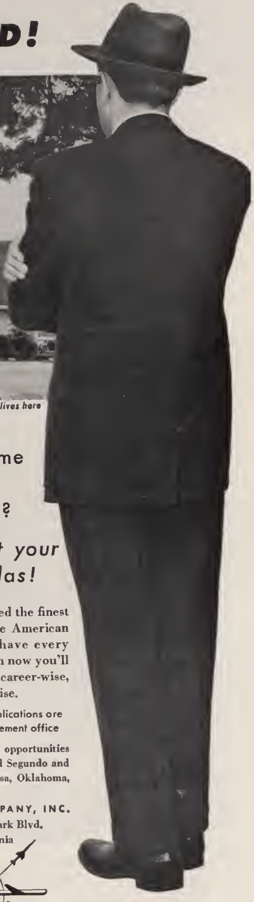

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the Mecheleciv

VOL. 15 MAY 1956 NO. 6

SCHOOL OF ENGINEERING, THE GEORGE WASHINGTON UNIVERSITY

IN THIS ISSUE

DEPARTMENTS

ON OUR COVER

Just what the years to come hold in store for the June engineering graduate is a matter of great concern at the present stage of the world's history. However, an educated guess would lead down the path of achievement to a rewarding professional life.

COVER BY LENORE ALEXANDER

FRONTISPIECE

High above snow-capped peaks, this B-47 is guzzling fuel at a rate of up to 600,000 pounds of fuel an hour. The General Electric fuel-measuring transmitter, located on the flying tanker's line, represents a substantial increase over the previous 12,000 pound rate.

GENERAL ELECTRIC PHOTO

Published at the George Washington University by direction of the Engineers' Council. Published six times during the school year in October, November, December, March, April, and May. Entered as second class matter March 6, 1951, at the Post Office at Washington, D. C., under the act of March 3, 1879. Address communications to Mecheleciv Magazine, Davis-Hodgkins House, George Washington University, Washington 6, D. C. or telephone STerling 3-0250, Extension 528.

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MARTIN
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FACULTY PAGE

GRADUATE STUDY - A PHASE OF CAREER DEVELOPMENT

By JOHN KAYE

Associate Professor of Mechanical Engineering

Each engineering student and graduate faces at least once the question, "Shall I engage in graduate study?"

Many engineers achieve success without the aid of graduate study, either because they obtain its equivalent through other activities or because graduate study is not necessary for their work. At one extreme the engineer who succeeds in design, development, or research needs a considerable depth of understanding of physical phenomena. He gains this through a degree program, individual courses, self-study or by learning on the job. At the other extreme, the sales engineer needs a lesser depth of knowledge of physical phenomena but a much broader knowledge of human behavior and human affairs to cope with the less tangible factors involved in selling his product. An undergraduate level of knowledge may be adequate. This he may gain either through courses, self-study, or general reading, discussion and observation. Therefore, whether graduate study is desirable depends upon the career objectives of each person.

The total problem, then, is preparation of a program of professional development with graduate study as only one of many elements to consider. Preparation of such a program calls for deciding professional objectives in life, investigating the requirements to reach these goals, and planning the action to fulfill the requirements. The end result should be a flexible plan for achieving the goals which now appear important or which one believes may be important. The flexibility is needed to accommodate changes in goals as well as in the external situation. The process resembles engineering design, starting with a concept, going to a sketch, layout, details, and final prints, accompanied by many modifications at all stages, but becoming more definite in specific aspects as the time for each action approaches. Just as the usefulness of drawings to a craftsman depends upon their clarity and conformance to realities, so does the usefulness of the plan depend upon its definiteness and acceptance of the facts of life.

Comparison of career development requirements with engineering graduate study programs will show whether such study appears desirable. The basic purpose of graduate study at the Master's level is, of course, to develop greater competence in engineering. However, a comparison of programs at different schools reveals that the nature of the competence which will be developed depends upon the school. Programs differ in the emphasis placed on various aspects. They differ in the proportions of studies in the science and art of engineering. They also differ in the depth and breadth of coverage, in that some emphasize specialization in a limited area whereas others cover a broader field. Similarly, they differ in the extent of original work required, some specifying a research thesis while others consist entirely of course work. Additionally, they differ in the proportion of courses in analysis to develop ability to understand new problems in contrast to courses in synthesis, such as design and laboratory, which require putting together knowledge from several areas. In general, they require advanced mathematics which serves not only as a tool for solving more advanced problems, but also as a means for seeing the unity of the various areas of engineering through the mathematical methods used.

Another purpose for graduate study is to change goals. This is the case with our program in Engineering Administration for those engineers and scientists who wish to prepare themselves in the different area of administration. Others study law or some other specialty to broaden their backgrounds.

The choice of a program of study is a guide to selection of the school to attend. The ideal school is the one which has an established reputation for achieving

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The Magnetron Beam Switching Tube

By John R. Manning
BSE '57

John Manning is well qualified to write on the subject of beam switching tubes, for he is employed as a patent searcher by the Burroughs Corp. John is taking his B.S.E. with a chemistry option and plans to attend law school after getting his bachelor's degree in 1957. He is an active member of A.I.E.E.-I.R.E., Theta Tau and the Newman Club on campus.

Probably the major usefulness of electron tubes has generally been accepted as that of passing currents of various magnitudes and characteristics. Out of the complex growth of the electronic industry in recent years, especially in the fields of computers, instrumentation and communications, there has evolved a fundamental pattern of electron distribution. Vacuum tubes, gas tubes, crystal diodes, transistors and magnetic cores have been used for such applications with varying degrees of satisfaction. These systems generally are inherently limited to specific types of inputs, degrees of complexity, impedances, frequencies, voltages and currents.

The Magnetron Beam Switching (MBS)* tube establishes a theorem that each position of an electron beam distributor should be capable of forming the electron beam, switching the beam in a number of ways, providing a useful pentode-like output, and be able to clear or cut off the electron beam.

Before we go into the structure, operation and applications of the MBS tube, it may be well to review the motion of an electron in magnetic and electric fields.

An electron starting at a certain initial velocity in a homogeneous magnetic field without being actuated by other forces, moves in a path the projection of which is circular in a plane perpendicular to the magnetic field. If the starting velocity has a component parallel with the magnetic field or if an electric field parallel with the magnetic field is present, the center of the circular path is displaced at the speed of the component in parallel with the magnetic field so that a helical path is described.

This electron movement may now be influenced by a disturbing force forming an angle to the magnetic field and being caused by an electric field or by an inhomogeneity in the magnetic field, or by a combination of the two factors. The component of the disturbing force in the plane perpendicular to the magnetic field results in that the center of the circular movement is displaced in a direction which is substantially perpendicular both to the disturbing component and to the magnetic field. The velocity of the displacement is proportional to the intensity of the disturbing component. The projection of the electron path in the plane perpendicular to the magnetic field will then be trochoidal. The base line followed by the center of the circular movement during its progressive movement is in each point of the line determined by the intensity and direction of the disturbing force, i.e. the structure of the electric and magnetic fields. Therefore, it is rendered possible to change the form of the base line in a variety of different manners so that the path of the electron current may be directed practically in any arbitrary course.

The above described electron movement may be produced in a vessel evacuated to a suitable low pressure in which vessel a certain velocity is imparted to the electrons emanating from an electron emitting source (a cathode) and in which the electrons are subjected to a magnetic field. Through the action of the magnetic field the electron paths are curved so that the electrons are forced together within a region adjacent to the electron source. Through the action of an electric field or inhomogeneities in the magnetic field as well as due to any initial velocity in the direction of the magnetic field which

*Trademark—Burroughs Corporation

the electron source may have imparted to the electrons, the electron paths are so displaced that the region is extended to form an electron channel or group projecting from the electron source. The width of this channel is dependent upon the diameter of the circular paths of the electrons. The electrons are retained within the channel by the magnetic field.

The path of the electron channel through the tube is determined by the intensity and direction of the magnetic and electric fields in different points and the conditions on which the electron current leaves the electron source. The MBS tube relates to means adapted to change the course of the electron channel, the change being utilized for changing the distribution of the electron current on the receiver electrodes.

DESCRIPTION OF TUBE

In order to perform the functions of beam switching, the Magnetron Beam Switching tube has at each individual position, of which there are ten, three basic electrodes of proper impedance characteristics. They are: (1) A SPADE to "automatically" form and lock the beam, using a minimum of power with a high degree of reliability and substantially independent of frequency. (2) A TARGET OUTPUT PLATE or TARGET with an efficient high current pentode-like output. (3) A SWITCHING GRID, adaptable to all types of inputs, which will switch at high speeds for high speed sequential switching without drawing current.

A building-block versatility for each position results whereby electrodes may be interconnected in almost unlimited combinations, either sequentially or at random, both within the same vacuum tube envelope and between separate vacuum tubes.

The tube consists of ten such positions mounted radially about a central cathode and operating in the presence of an axial magnetic field. This magnetic field is provided by a small cylindrical magnet permanently attached to the evacuated glass envelope. The electric field is supplied by different potentials applied to the various electrodes. The overall length of the tube is three inches and with the magnet in place, slightly over one and one-half inches in diameter. The MBS tube could be described as ten triodes in a single envelope and capable of yielding a pentode-type output. More will be said of this feature later.

At this point it may be well to mention the various objects of the MBS tube that distinguish it from other switching tubes known in the art. A few of the objects and superior features of the MBS tube are:

(1) An increased output current since further increases in power output are always desirable in order to extend the utility of the tube.

(2) Isolation of the holding and beam switching functions of the tube from each other so that each element can perform its function substantially independently of the others.

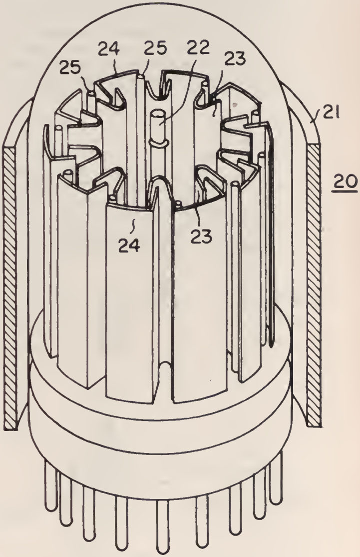
(3) Reduction of cross talk and noise to a minimum by providing electrical isolation from current so beam is confined to the desired output electrode.

(4) Provides a structure which is capable of handling a signal having a high percentage of modulation without affecting stability of operation.

(5) Provides a tube structure in which the beam switching may be rapid and in which the unmodulated output signal approaches a square wave in form.

(6) To provide a tube in which a change of potential at the output electrodes does not substantially tend to change the output current afforded by the beam over a wide range of output potential variations. This is a common pentode characteristic and is desirable when varying amplitude signals are to be used such as audio, video, radio, or other signals modulated by some intelligence pattern.

(7) To provide a beam switching tube capable of operation with a minimum of external circuitry.



Basic MBS Tube Structure

OPERATION OF TUBE

The spades are the only electrodes that directly affect the beam formation from the cathode. Operating voltages of the spades are normally 1/3 to 1/4 the theoretical diode cutoff value for the magnetic field strength (typical Vs = 100 volts: B = 400 gauss). Each spade has a negative characteristic due to the crossed electric and magnetic fields, and therefore is capable of bistable states. The beam may be formed in any one of its ten "on" positions by sufficiently lowering the potential of the respective spade; from point 'C' where the negative

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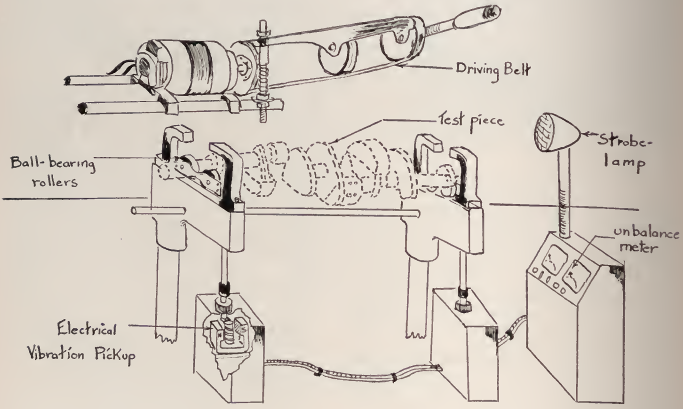
ENGINE BALANCING

By Jack Brandau, BME '56

Jack Brandau, whose article on the Texas Tower appeared in the March issue, gives here his second contribution to these pages. Jack is a familiar figure on campus; he is active in the A.S.M.E. and Sigma Tau, and recently received the first Mahler Materials Testing Award given at G. W.



Automotive type "Dynetric" Balancing Machine

Most people have noticed, no doubt, how some automobile engines seem to run without effort, and others, often of the same make and models, seem to labor and throb all the time they are running. Every revolution of their crankshafts can seemingly be felt by the passengers in the automobile. One big reason for engines which are built in the same factory with identical specifications to run differently is due to vibration of the engine.

"*Vibration*" is defined as a periodic motion of the particles of an elastic body in alternately opposite directions from the positions of equilibrium, once this equilibrium is disturbed. In a body made of rubber, such vibrations are easily visualized and in objects of iron and steel, such movements, although harder to comprehend, are quite real.

Two factors are necessary to have vibrations. They are (1) a body to vibrate and (2) a force to move the body from its equilibrium position. The force must be applied and then quickly removed.

In an engine, the two main causes of vibration are the variations in gas pressure on the piston and cylinders; and the state of balance of the rotating and reciprocating parts of its crankshaft, connecting rod, piston and flywheel assembly.

Compression and combustion pressures depend primarily on the engine's compression ratio and the shape of its combustion chambers, the latter determining the turbulence and, therefore, the burning characteristics of the fuel and air mixture inducted. Engine "roughness," as far as turbulence is concerned, is difficult to correct, but the mechanic *can* control fuel mixture, spark timing and chamber surface conditions to minimize preignition and detonation, the major vibration causes.

The state of balance of an engine's crankshaft, connecting rod, piston, and flywheel assembly is generally known as a "mechanical balancing." These parts are balanced at the factory, but the final success of the balancing job depends on a "lucky" selection of parts used in the engine, because when parts are balanced on a mass production basis, tolerances are large and one engine may receive some parts which were overweight and some which were underweight. The usual tolerance on factory parts is ½ oz. If, by chance, a group of parts, which were low on the tolerance scale, were assembled together, the engine would be smooth running and vibration-free, but if the group of parts weighed high on the tolerance scale, or some high and some low, the engine will run "rough".

The basic reason for such phenomena is due to the centrifugal forces which act on rotating bodies, especially at certain rotative speeds, when there are *heavy spots* somewhere on the body and likewise the inequality of weight along a reciprocating part causes unequal forces on the rotating member connected to it. Reciprocating parts must be balanced by equalizing the weight of individual parts, or a combination, that is on connecting rods, all upper ends should weigh the same and all lower ends should weigh the same. Therefore, if the above mentioned parts could be precisely balanced, a smooth engine most likely would result. There are a number of firms which specialize in engine balancing on automobile, truck and motorcycle engines and as a comparison to the tolerance of ½ oz. on factory work, only ½ gram is allowed on pistons and connecting rods and 1 gram-inch is allowed for crankshafts and flywheels, whereas ½ oz.-inch was used in the factory. One oz. equals 28.35 grams.

Newer cars have very fine flexible engine mount designs in order to isolate engine vibrations from the auto body, but even though a high percentage of the mechanical vibration is damped out, those unbalanced forces are still doing their damage *inside* the engine and the main bearings which support and prevent movement of the crankshaft are being subjected to high pressure which is exerted all the way around the bearing as the crankshaft rotates. A hammering effect is created on the soft bearing and should the journal pressure become great enough so that the oil film be broken down, the bearings could be destroyed in a matter of seconds.

Rotating parts are subject to two types of balance: "*static*" and "*dynamic.*" Static balance requires the total weight of an object to be disposed about its axis in such a manner that a heavy point on one side of the axis is counter-balanced by an equally heavy point on the opposite side. Thus, weight must be added or removed from the object so that when placed in any position, it will remain at rest and not rotate.

However, when the object is rotated at high speed, it will again vibrate because centrifugal force tends to pull the heavy portions of the unbalanced sections away from the axis. Therefore, counter-balancing must be done as in figures C & D. Dynamic balance requires then that the balancing weight be placed opposite to and in the same plane as the unbalanced weight.

The art of engine balancing is being studied by the experts and they find that several balancing situations exist. An in-line engine is balanced by equalizing the weight of its reciprocating parts and dynamically balancing its bare crankshaft, while for "V" type engines, the crankshaft must be balanced with bob-weights attached to the crank throws. These bob-weights give the effect of the piston, connecting rod and bearing assemblies which will be later attached to the crankshaft. The balancing operations are usually carried on systematically, step-by-step, and the rotating parts are balanced by means of electronic circuit machines using stroboscopic lights. The parts required of an engine are: piston, piston pins, connecting rods, pin locks, rings, rod nut locks, connecting rod inserts and the crankshaft, flywheel and clutch pressure plate assembly. Again weights of reciprocating parts are held to a tolerance of ½ gram and rotating parts to 1-inch gram.

1. The first operation is *balancing piston and pin* assemblies. All assemblies are weighed until the lightest is found, and then the weights of the heavier pistons are reduced to this weight by chucking them on a lathe and removing material from the lower web of the skirt.
2. *Balancing: connecting rods*—The large and small ends are weighed by hanging them below a scale and finding the lightest large and small end. Then grinding allows all others to be reduced to this weight. Then all rods are checked for total weight and further grinding (always parallel to the rod shank) is done to bring all rods to the same total weight. Alignment should then be checked.
3. *Balancing: crankshaft*—In-line and single plane cranks can be immediately balanced, but two-plane cranks, such as in the Ford and Mercury V-8's, must have specific bob-weights made up. Bronze bob-weights made equal to the weights of various rotating and reciprocating parts are used. These are bolted around the journal by means of Allen-head screws.

   The *Machines* used consist of: two sets of ball bearing rollers arranged to support round objects, an electric motor-driven rubber belt, sensitive electronic units beneath the ball bearing rollers

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THE ENGINEER AND HIS MILITARY OBLIGATION

By

PAUL L. O'NEIL

Although articles for MECHELECIV are usually written by students of the School of Engineering at George Washington, an outside expert is sometimes required on special subjects. Paul L. O'Neil graduated from the University of Maine in 1952 with a B.S. in Engineering Physics with Mechanical Engineering. He was employed by the Westinghouse Electric Corp. from June 1952 until May 1954 as an application engineer at the Steam Division in Philadelphia. In May 1954 he was inducted into the Army, a connection which prompted the writing of this article. Mr. O'Neil is, however, connected to the MECHELECIV staff by virtue of being married to staff writer Pat O'Neil.

At the time of this writing, the weather has turned balmy and my beloved Red Sox are taking their annual thumping at the hands of the Yankees, all of which means to you, the senior engineering student, that spring, the time for finals, graduation, and settling into your life's work is at hand. Included in this picture is the practical certainty that sooner or later within the next few years, you will fulfill your military obligation to your country, unless you are found physically, mentally or morally unfit to serve.

Right about here, you're probably wondering, "Does the fact that I'm an engineer have any effect on the way that my military obligation can be fulfilled?" Very probably, the answer to that question is yes.

Several choices of ways to fulfill this obligation are open to you, some of which are listed below:

1. Enlistment for three to four years of active duty with the subsequent Reserve obligations that such an enlistment entails.

2. Go to work and await normal draft call. Then serve two years on active duty and four years in the Ready Reserve with the possibility of being screened into the standby Reserve. Incidentally, being an engineer, this course offers the possibilty of being deferred for a while (subject to your local draft board's needs, of course) during which time you will probably accrue enough professional experience to qualify for a Scientific and Professional rating in the Army. Such men, after basic training, are generally utilized in specific engineering fields such as weapons or automotive development and testing, electronics, etc.

3. Go to work and then apply for an eight year enlistment in the Ready Reserve which includes 3 to 6 months of training on active duty and the remainder of the eight years on Reserve status, providing, of course that you qualify for this program.

This last choice seems to be one that offers the best solution to the problem of engineers being drained from critical civilian industry by the Armed Forces. It offers to those qualified individuals who make this choice the advantage of short *active* duty time and compensates for the apparent inequity of discriminating against non-technical men, by a military obligation that is two years longer, even though this two years is in reserve status.

Here, basically is how the "six month program" operates.

On January 6, 1956, President Eisenhower signed Executive Orders #10650 and 10651 to implement Public Law #305 (Reserve Forces Act of 1955), "governing the selection for enlistment in the Ready Reserve—— of certain persons who have critical skills———" and providing for the screening of the Ready Reserve with the object of transferring to the Standby Reserve certain persons who have critical skills and who are principally employed in critical defense supporting civilian industries or in research activities supporting the national defense.

At this point it might be well to point up the Reserve structure of the Armed Forces. It consists essentially of two parts:

1. The Ready Reserve. which may be activated at time by the President. This Reserve has in itself two parts:

   A. Active—Attend regular meetings for drill and instruction and goes on active duty for approximately two weeks each year. (The majority of those men drafted under the present law will probably be in this group for four years after completion of two years active duty.)

   B. Inactive—Does not attend meetings or activate each year but is still subject to immediate call. (This group is not *generally* open to men drafted under the present regulations, but is available to men now completing two years of active duty under the old eight year obligation.)

2. The Standby Reserve—Which may be activated only by act of Congress. Does not hold regular meetings. Does not activate for yearly training.

Now to you, the graduate engineer. Executive Order 10650 Part 1680 specifies the following:

1. Local draft boards are authorized to select for enlistment in the Ready Reserve persons who have critical skills and are engaged in critical defense—supporting industry or in research activities affecting the national defense. Said enlistments will be for a period of eight years starting with a three to six month period of active training in a Reserve of an Armed Force conducting an approved training program. (At present, only the Army is conducting such a program.) In Operations Bulletin #138, January 12, 1956, Director of Selective Service Lewis B. Hershey states that persons so enlisted may be relieved of training requirements except for the initial 3-6 month period of active duty. In short, upon completion of the 3-6 month training one *may* enter the Standby Reserve.

Local boards shall be guided in the selection of registrants for this program by the then current list

of critical skills and activities prepared by the Secretary of Commerce.

2. Any registrant believing that he qualifies for this program by virtue of possession of a critical skill being utilized in a critical industry may file a written request with his local board that he be selected for enlistment in the Ready Reserve under the provisions of section 262 of the Armed Forces Reserve Act of 1952 as amended. Anyone submitting such a request must be in class 1-A, may not have an appeal pending, and the period for filing an appeal must have expired.

3. Any written request must contain the following:

a. Certification by the registrant *and his employer* that he does possess a critical skill being utilized in critical industry.

b. Evidence that registrant has by his academic and/or employment records shown that he is capable of and gives promise of fulfilling the duties of the previously described occupation.

c. A written statement by the registrant that after completing the prescribed 3-6 month tour of active duty, he intends to return to his former employment or to enter employment in a critical field where his skill will be utilized.

4. Upon receipt of registrant's request, the local board immediately suspends all action toward inducting registrant except to order him to a preinduction examination if he has not already had one. If this examination is failed, applicant naturally becomes unfit for service. However, if examination is passed, the local board forwards the registrant's application for Reserve enlistment to a State Advisory Committee on Scientific, Engineering and Specialized Personnel (State Selective Headquarters) for recommendations.

5. Upon receipt of the recommendations of this committee the local board shall consider the case and either approve or dissapprove the request.

6. If the request is approved, applicant normally has 30 days to enlist in the Ready Reserve program for which he has applied, or such longer extension of this period that the local board may grant.

7. If the request is disapproved, applicant has recourse to appeal the determination of his case.

Following is a current partial list of critical skills as applied to scientific and engineering personnel:

Chemist Physicist Parasitologist (plant and animal) Mathematician Microbiologist (includes Bacteriologist).

The above listed classifications are limited to those having graduate degrees in their fields, or equivalent experience, education and training (generally considered not less than one year beyond bachelor degree level).

Engineer Draftsman, Design

Engineer Professional (all branches)

Geologist

Geophysicist

Teacher, College and Vocational (critical occupations only)

Teacher, High School (math, physical and biological sciences)

Tool and Die Designer

Requirement for these classifications is bachelor degree.

CRITICAL ACTIVITIES

1. PRODUCTION AND MAINTENANCE OF AIRCRAFT AND PARTS
   Production, maintenance, and repair of military aircraft and component parts.
2. SHIP AND BOAT ENGINEERING
   Engineering and design of ships and boats and their components for military purposes.
3. ORDNANCE
   Production and maintenance of weapons (including nuclear weapons and guided missiles) and component parts.
4. PRECISION LABORATORY INSTRUMENTS, AND SCIENTIFIC LABORATORY GLASSWARE
   Production of complex or custom blown scientific and technical and laboratory glassware. Production of precision laboratory instruments such as analytical balances, centrifuges, spectrographs, spectrophotometers, microtomes, pH instruments, galvanometers, potentiometric devices, etc.
5. PRODUCTION OF ELECTRONIC AND COMMUNICATION EQUIPMENT
   Production of electronic and communication equipment for military use.
6. PRODUCTION OF CHEMICAL AND ALLIED PRODUCTS
   Production of materials specifically used in propellants for launched or guided missiles, aircraft, armament rockets, and similar weapons, as well as the processing of the materials into propellants, exclusive of conventional fuels. Production of high temperature resins and other chemicals used specifically in the production of launched or guided missiles, aircraft, armament rockets, and similar weapons.
7. WATER AND SEWERAGE SYSTEMS
   Operation of water and sewerage systems.
8. HEALTH AND WELFARE SERVICES
   Personal medical, dental and nursing services: hospitals; public health services.
9. EDUCATIONAL SERVICES
   Colleges and vocational schools and high school instruction in mathematics and physical and biological sciences.
10. RESEARCH AND DEVELOPMENT SERVICES
    Basic and applied research, exploration and development projects, including process development, of direct concern to the national health, safety, or interest.

One word of caution: any engineer or other technical man once embarked upon the Ready Reserve program, must remain in a critical activity utilizing his skills until the total eight years is completed. If during his tour of Reserve duty, he leaves such activity he will be screened from the Standby Reserve into the Ready Reserve subject to immediate recall to active duty.

For further information, write to:

Engineering Manpower Commission
of
Engineer's Joint Council
29 W. 39th St., New York 18, N. Y.

And ask for EMC-SMC Newsletters #88 and #91 dated Jan. 18 and Mar. 23 '56.

Our 1956 Graduates

THE MECHELECIV TAKES PLEASURE IN PRESENTING SCHOOL OF ENGINEERING GRADUATES

For The 1955-56 School Year

Presented Through The Courtesy Of

THE ENGINEERING SOCIETIES AND FRATERNITIES

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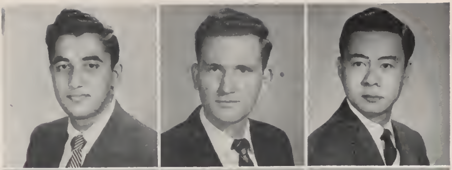

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Societies and Fraternities

CONTRIBUTING THESE PAGES FOR OUR 1956 GRADUATES

THETA TAU

Gamma Beta Chapter

SIGMA TAU

Xi Chapter

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Student Branch

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

INSTITUTE OF RADIO ENGINEERS

Joint Student Branch

First Row:

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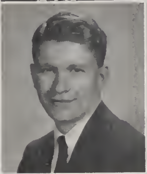
Second Row:

MICHAEL A. SILEO, JR., Newark, New Jersey; B.S.E., Business Administration; Phi Kappa Alpha; Alpha Kappa Psi; Newman Club; Varsity Football; Intramurals. JOHN HENRY SLOTHOWER, Silver Spring, Maryland; B.E.E. Communications; Engineers' Council, President A.I.E.E. I.R.E.. WILLIAM C. STAMPER, Arlington, Va.; B.C.E.; Theta Tau; Mecheleciv, Business Manager; A.S.C.EE., President.



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CURTIS MONTAGUE STOUT, Colmar Manor, Md. B.E.E., Communications; I.R.E. G. M. STUDDS, Alexandria, Va.; B.M.E.; A.S.M.E. JAMES FRANKLIN SAUNDERS, Arlington, Va.: B.C.E.; Sigma Tau; Theta Tau; A.S.C.E., Secretary.

Fourth Row:

VICTOR ROY YUROW, Washington, D. C.; B.M.E.; Alpha Epsilon Pi; Theta Tau; Intramurals; A.S.M.E.

. . . Cuts courtesy of the Cherry Tree and Benson Printing Company.

GRADUATES NOT PICTURED

Stephen F. Anderson, Jr. -------- Silver Spring, Md.
Walter J. Bienia ------------------ Greenbelt, Md.
Baland C. Burns ------------------ Arlington, Va.
Joseph E. Cooper ----------------- Arlington, Va.
George E. Decker -------------- Washington, D. C.
Sylvester J. Diehl ------------- Washington, D. C.
Louis J. Dougherty ------------ Washington, D. C.
Eric R. Enholm ------------------- Arlington, Va.
Donald B. Feder ---------------- Washington, D. C.
Maxwell K. Foster ------------ Washington, D. C.
Lester A. Lawrence -------------- Falls Church, Va.
William H. McMakin ------------ Washington, D. C.
Harry K. Morlock -------------- Washington, D. C.
James B. Murray --------------- College Park, Md.
Henry B. Paris -------------------- Alexandria, Va.
Gustave Shapio ---------------- Washington, D. C.
Julius S. Strojny ----------------- Hyattsville, Md.
Juan Torrealba ---------------- Washington, D. C.
Edward A. Willis, Jr. --------------- Arlington, Va.

The 1956 Engineers' Banquet and Ball

The Washington Room of Hotel Washington was a scene of gay activity on the evening of May 5, 1956 when the Engineers of GWU held the 1956 Engineers' Banquet and Ball. The annual highlight of the engineers' social season turned out to be one of the best attended in years with over 200 undergrads, graduate students, alumni, and faculty members taking part in the festivities.

The Chairman of the 1956 Banquet and Ball Committee, Tom Creswell, kicked off the activity by introducing the people at the head table after which Professor "Deacon" Ames offered the prayer. The next forty-five minutes were devoted to disposing of the turkey dinners which drew several favorable comments from the gourmets of the crowd.

Dean Martin A. Mason regaled the diners with a short after-dinner speech liberally spiced with humor and also containing the more serious message that we are now leaving the era of the uncommon people who played such a large part in establishing the character of the School of Engineering and are entering the era of the uncommon school.

After Dean Mason's speech, Sam Mawhood, President of the Engineers' Council, was introduced and acted as M. C. for the remainder of the program.

The A.S.C.E. Prize Paper Awards were presented by Professor Walther to Walt Evans, junior, and Bill Stamper, senior.

Professor Norman B. Ames (the Deacon) receives a watch commemorating his years of service to the student body. The Deacon is a member of Theta Tau, having founded Gamma Beta Chapter, Sigma Tau and the A.I.E.E. on campus.

Council President Sam Mawhood made the presentation.

Barwick Photo.

(Ed. Note) Each year the Engineers' Council holds a Banquet and Ball for the faculty, students and guests of the School of Engineering. To those who went, these pages need only serve the purpose of a memory; for those who did not attend, these pages should be a prod . . . It has been said that once you go, you never miss it again.

Professor Greeley announced that the A.S.M.E. Prize Paper Award was won by Jack Brandau and also that the Headquarters A.S.M.E. Award for the student who has given the most outstanding service to the chapter during the past year was won by John Cannon.

The I.R.E. Contest winners, Don Keever and Harry Morlock, who got the highest marks in a test given by the District of Columbia Chapter of I. R. E., were introduced by Professor Hanrahan who also announced that the A.I.E.E. Award for outstanding service to the chapter was won by Gope Hingorani.

The Sigma Tau Freshman Award was presented to Moyassar Y. Al-Mallah by Sigma Tau President Irv Schick who proved as adept at the art of after-dinner speaking as Dean Mason.

The Theta Tau Outstanding Senior Award was presented by Dean Mason to Sam Mawhood. To make his evening doubly complete, Sam also got a gavel in recognition of his service as council president.

Mecheleciv Keys were presented by Faculty Advisor Ames to Jim Cauffman, Paul Goozh, Bobby Holland, Pat O'Neil, Jerry Renton, Vince Rider, Bob Shuken, and Ray Sullivan.

Engineers' Council Keys were presented by Faculty Advisor Cruickshanks to Joe Bell, Jim Cauffman, Tom Creswell, Howard Davis, Joe Greblunas, Gope Hingorani, Orrin Kee, Theresa Koontz, Tony Lane, John Madaris, Harlan Oelke, Earl Reber, and Bill Stamper.

Tom Creswell, outgoing President of Sigma Tau, received the Sigma Tau Gavel from Professor Cruickshanks after which Sam Mawhood introduced the incoming officers of the various School of Engineering activities.

On behalf of the students and alumni, Sam Mawhood made a special award of a pocket watch to Professor Ames as a "going-away" gift in view of his trip to Ceylon next month and to make sure that he's on time to catch the ship for his return next year. Earl Reber, current Regent of Theta Tau, then presented Professor Ames with a watch chain from the members of Theta Tau. Professor Ames then reciprocated by presenting Matt with the Theta Tau Gavel as a token of appreciation for the job he did during the past year as Regent.

Next, Sam introduced the members of the Engineers' Council for next year who have already been elected. They were as follows: Graduate School—Jack Crenca and Bill Grady; Senior Class—Joe Greblunas and Tony Lane; Junior Class—Jerry Renton and Mickey Boothe; Sophomore Class—Jim Somervell and Charles Watts;

Dean Mason speaks to the assembled engineers and guests. ***Barwick Photo.***

A. S. C. E.—Walt Evans; A. S. M. E.—Howard Davis; I. R. E.—Warren Crockett; Sigma Tau—Dan Palmasani.

The final award, an engraved certificate and a pocket watch with chain was made to retiring Professor Robert Trumbull who is retiring from GWU but who expects to teach next year at the University of Tennessee. Sam Mawhood then announced that Professor Trumbull has been awarded the title of Professor Emeritus.

At intervals between dancing to the exceptionally good music of Sonny Seixas and his orchestra, drawings for door prizes were held. Paul Robey, Jim Cauffman, Bill Grady, and Professor Greeley were the lucky winners.

The music ran the gamut from throbbing Latin rhythms to rousing polkas and was good enough to entice even the die-hards out on the floor.

The Ball ended at midnight due to the D. C. Saturday night curfew but several groups carried on in parties at private homes. An especially large group was seen walking toward the Howard Johnson's on 14th Street singing what sounded like, "We're going to Carl's house." The latest word is that they settled for Howard Johnson's instead.

S.P.E. VIEWPOINT ON E.C.P.D.

(Editor's Note)—This article represents the considered viewpoint of engineers who are well-informed on their subject. It is, however, a viewpoint in answer to an editorial. The opinions expressed here do not necessarily reflect the editorial opinion or policy of Mecheleciv or of the George Washington University.

In the March issue of MECHELECIV, Professor Cruickshanks had an article entitled "Is E.C.P.D. on the Ball?" Some of the statements in this article we agree to be absolutely true; some we think might be misinterpreted; and with others we have to disagree.

First of all, Professor Cruickshanks raises the question of requiring engineering graduates, of a school whose curricula, etc., have been approved by E.C.P.D., to take "in-training" examinations. He points out that "holders of engineering degrees have just finished four or more years satisfying a faculty of specialists (approved by E.C.P.D.), yet are immediately subjected to re-amination in the same subjects."

Now, in issuing a license or certificate to an engineer, the licensing board is faced with the responsibility of granting the engineer the authority to practice his profession with its important relationships to public welfare and safety. In most states and in the District of Columbia, the license is issued in two parts. The Engineer-in-Training certificate is issued soon after the engineer graduates and the full license after a period of required experience and another exam. It is true that the first exam covers the very subject and range of knowledge which are taught in an approved engineering course. Most licensing boards recognize the importance of an approved course of instruction by giving credit only to those curricula which are approved by E.C.P.D. in qualifying the applicant as to educational requirements.

If every student graduating from an approved engineering school was fully qualified to practice first as an engineer-in-training and, after subsequent examination, as a licensed engineer, there would be no need for an examination. Unfortunately, this is not the situation. The truth is that many engineering graduates, even though subjected to an approved curriculum taught by competent instructors, are not qualified either to pass the examination or to practice as professional engineers. This is true not only in engineering but in virtually every other profession as well.

If every graduate were fully qualified, then the issuance of a license could be an automatic function and every graduate so desiring could be given a license upon graduation. In much the same way, if every student in an approved engineering school received the full benefit of his instruction, there would be no need for final examinations in any of his courses. We all know that this is not the case, and it is fairly certain that we all know of at least one case where a student passed his courses and received his degree without possessing the knowledge necesary to pass his examinations honestly.

We agree with Professor Cruickshanks that the men who conduct the licensing examinations are in many cases inexperienced and feel that this situation should be corrected. In Virginia the engineering schools work very closely with the licensing board, and in many cases the members of the board are, or have been, members of the faculty of these schools.

In the case mentioned by Professor Cruickshanks in which 50% of a group taking a licensing examination failed, we also question who was at fault — the applicants or the board of examiners.

We feel that student assistants should definitely not be allowed to grade such examinations and agree that such practice does nothing to enhance the profession in the eyes of the young engineer. The grading of these examinations is of vital concern both to the engineering profession and to the general public. If students who are not yet possessed of the qualifications necessary to practice a licensed engineers are allowed to grade the examinations of those who presumably are ready to practice, then the whole purpose of the examination is lost.

We entirely disagree with what Professor Cruickshanks has to say about graduates being urged to take "in-training" examinations immediately as a membership "come on" to get them in line and begin paying an annual fee to avoid a subsequent examination. The only reason the graduates are urged (if such is actually true) to take this examination soon after graduation is to make it as easy as possible for them to pass. Everyone knows that certain fundamentals of physics and engineering are forgotten with the passage of time, especially those fundamentals which are not actually used in practice. We doubt very much if every practicing engineer and every member of engineering faculties could pass the average "in-training" examination. This is no reflection on these people but merely points up the necessity for taking the examination while the fundamentals are still fresh in the mind.

We agree that a man should not have to register until such time as he feels the need, but should he foresee the need, it would be to his advantage to take his first examination as soon after graduation as possible. It is entirely up to the individual and certainly no one benefits from early examination except the individual. In the District of Columbia and in Virginia there is no annual fee charged to holders of Engineer-in-Training certificates — therefore, the annual fee business certainly does not apply locally and the certificate issued does not constitute "membership" in any organization.

Again we have to disagree with the statement that most large organizations are not concerned with the matter of registration. Virtually all of the large engineering organizations with which we are familiar have licensed engineers among their top men and encourage all their engineers to register. How can an organization practice engineering locally unless it has among its members registered engineers? As to municipal and Federal governments, even there the trend is toward registration. There are many registered engineers working for municipalities and the Federal Government, and the percentage of registered men employed by them is increasing rapidly. Many government engineering projects are being "farmed-out" to consultants who must be licensed engineers.

We agree that an investigation by E.C.P.D. is in order to try to cut down on the number of exams the present generation of engineers is forced to undergo. Perhaps an answer to the Engineer-in-Training exam would be to have the approved engineering schools themselves give the exam or certify as to the qualification of certain students to be issued a certificate. Let us not, however, fool ourselves in the belief that every engineering graduate of an approved school is fully versed in engineering fundamentals.

Robert F. Kursch, P.E.
P. B. Mansfield, P.E.
Herbert Manuccia, P.E.

A Committee of the Northern Virginia Chapter of the Virginia Society of Professional Engineers.

The Year In Review

Once again in the last issue of the year, MECHELECIV presents a recapitulation of the major events of the GWU School of Engineering during the past year. Those of you who have been reading this magazine consistently during the year will find little new in this article. However, we have been led to believe that there are two or three students who haven't received each and every issue (joke) and we hope this article fills in some of the details they may have missed.

A lot of hard work over the summer by a group of engineers led by the Engineers' Council provided the Davis-Hodgkins House with a "new look" in the form of fresh paint throughout, sanded and refinished floors with rugs on them, repair of broken plaster and woodwork, and general "field day." Due partly to the more attractive decor and partly to the widespread distribution of "the word" that the house was for the use of *all* engineers, the D-H House has enjoyed a higher degree of popularity than ever before.

The Engineers' Council, under the direction of Council President Sam Mawhood, held regular meetings over the summer months and, as a result, provided the returning and new students with several innovations in addition to the more attractive D-H House. The council assisted at registration time to help the new and younger students become oriented during the hurly-burly registration commotion. A student engineering calendar was ready for all students at the beginning of the school year. The calendar covered the ten months spanning the school year and listed most of the events of interest to student engineers.

The first big social event of the year, the Engineers' Mixer, took place on October 7 in Lisner Lounge where over a hundred students and faculty members enjoyed a lunch and a clever skit by Jim Cauffman and a few of his cohorts from the council. Apparently a good time was had by all and undoubtedly the new students attending came away with a deeper feeling of "belonging." Lack of an appropriate place to hold the Spring Mixer, coupled with a crowded schedule, led to cancellation of the second semester mixer.

The Christmas Tree Lighting Ceremony provided a nostalgic interlude during the holiday period.

Tompkins Hall, the new home of the engineers, has slowly taken form during the year on the 23rd Street edge of the campus and there are strong hopes that it will be ready for the Fall classes next year.

The customary engineering fraternity and professional society functions were held at their customary times during the year with their customary success. In addition to the regular functions, Theta Tau played host to a regional conference which wound up with a banquet at the Occidental Restaurant on March 17 that was well-attended by actives, alums, and visiting firemen.

During his welcome address to the delegates to the Theta Tau conference, University President Marvin announced that the new engineering building would have a "time vault" in which would be placed items representing engineering in 1956 and which would be marked for opening in 2056. We are proud to announce that MECHELECIV will be among the publications in the vault.

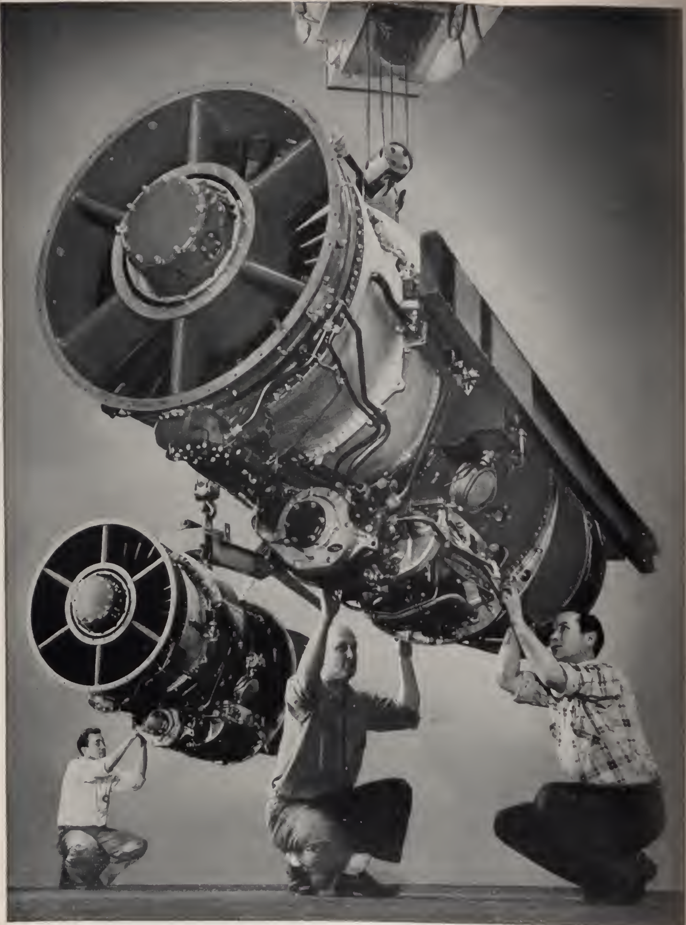
MECHELECIV has undergone a period of expansion during the year growing from an initial issue of 24 pages to this 44 page version. At the same time student and alumni mailing lists received much attention from the office staff so that we are hearing the old refrain, "I didn't get last month's MECHELECIV" much more infrequently.

Professor Ames, Executive Head of the E.E. Dept., was awarded a Fullbright lectureship in Electrical Engineering at the University of Ceylon. Professor Ames will leave the University at the end of this semester and expects to take up his teaching duties in Ceylon about July 1. The student body will sorely miss Professor Ames' leadership as a Professor, as a student advisor to several student activities, and as a personal friend to many of the students. The University of Ceylon's gain is our loss.

The big event of the Engineering social calendar, the Engineers' Banquet and Ball, was very successful and well-attended and is covered elsewhere in this issue. In addition to the usual awards, gifts were given to Professor Ames and retiring Professor Trumbull.

There has been some action on Engineers' Council Constitution revision such as giving the graduate student body two seats on the council and establishing the position of assistant treasurer.

So—on to glory in the finals and another year is gone. Best of luck in the finals and Godspeed to "Deacon" on his trip and to our graduating seniors embarking on the long and, we hope, successful journey through their professional careers.



The J-57, in the 10,000-pound thrust class, is the most powerful turbojet engine now in production. A new generation of U.S. air power has been designed around this mighty new Pratt & Whitney Aircraft engine.

North American's F-100 Super Sabre, fastest Air Force jet fighter, is powered by Pratt & Whitney Aircraft's J-57 engine.

First all-jet heavy U. S. Air Force bombers are the huge Boeing B-52s, powered by eight J-57s mounted in pairs.

The Douglas F4D Skyray, fastest Navy jet fighter, will be powered with the big J-57 engine.

The Douglas A3D, the Navy's most powerful carrier-based attack airplane, has two J-57 engines.

Blazing the Way for a New Generation of Air Power

The most powerful turbojet engine in production is blazing the way for a whole new generation of American aircraft.

That engine is Pratt & Whitney Aircraft's J-57, the first turbojet to achieve an official rating in the 10,000-pound thrust class.

But the J-57 provides far more than extreme high thrust. Its unique Pratt & Whitney Aircraft design, achieved after years of intensive research and engineering, offers as well the low specific fuel consumption so vital to jet-powered bombers and future transports, plus the additional important factor of fast acceleration.

The importance of the J-57 in America's air power program is clearly shown by the fact that it is the power plant for three of the new "century series" fighters for the U. S. Air Force—North American's F-100, McDonnell's F-101 and Convair's F-102—as well as Boeing's B-52 heavy bomber. The Navy, too, has chosen the J-57 for its most powerful attack aircraft, the Douglas A3D, the Douglas F4D fighter and for the Chance Vought F8U day fighter. And the J-57 will power the Boeing 707 jet transport.

The J-57 is fully justifying the long years and intensive effort required for its development, providing pace-setting performance for a new generation of American aircraft.

Engineering graduates who can see the challenge in this new generation, might well consider a career with the world's foremost designer and builder of aircraft engines.

PRATT & WHITNEY AIRCRAFT

DIVISION OF UNITED AIRCRAFT CORPORATION

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Switching Tube

(Continued from page 9)

characteristic will take over and lock in point "A" at near zero or cathode potential. Either a DC voltage or a high speed pulse may be used to trigger the beam formation. Thus the one spade which forms and locks the beam is near cathode potential, while the remaining ones are at a high positive level.

When a beam has been formed on a spade, it can remain there indefinitely, or it can be advanced in many ways. One method is by lowering the switching grid voltage to a value where it will change the electric field in the outer area between spades so that enough of the beam is diverted to the leading spade to cause that spade to assume its locked in stable state. The entire beam current is effective in quickly switching and lowering the potential of the leading spade. The lagging spade will remain at near zero potential for a longer time determined by its RC constant. An instantaneous condition results with two spades near zero potential.

The increased peak is due to the broader electric field obtained by two spades being at near cathode potential during sequential switching. This difference between the dynamic and the static spade characteristic is very valuable. It provides a means for switching the beam to a new position where a useful output may be obtained to perform a useful function and then automatically clear or cut itself off as the lagging spade discharges according to its time constant. The wide range of reliability of the function of Rs whether used for beam forming and locking where Rs = 100K; beam switching and locking where Rs = 100K; or beam switching and clearing where Rs = 40K, is indicated in Figure 3.

The grid is normally the electrode used for sequential switching since it performs its function without drawing appreciable current. Prior to switching, the beam is impinging upon the target (plate) electrode in a narrow channel along generally equipotential lines. The field configuration is such that the beam is well confined in position and does not tend to sneak behind the spade to an adjacent collector target and produce cross talk. Only a very small portion of the beam is intercepted by the spade so that a large amount of output current is available. When the grid has its potential reduced, the beam path will be displaced or defocussed toward the adjacent collector anode and thus into contact with the adjacent spade. As the beam impinges upon the outer end of the adjacent spade, the potential of the spade will drop and cause the beam to switch to the adjacent target electrode. The polarity of the magnetic field determines the direction of sequential switching which is clockwise in the figures shown. Because of their shape and position, the grid electrodes effect a very uniform switching action.

Although the grids are normally used for beam switching, the spade or target (plate) may also be used to perform this function.

It may be seen that considerable modulation of the electron beam may be achieved without adversely affecting the operating stability of the tube. The electron beam may be cathode modulated or modulated by means of a grid surrounding the cathode, although the latter method is less satisfactory in some applications.

APPLICATIONS

The simplicity and reliability of this new basic building block has been demonstrated in applications performing the following functions:

Distributing	Frequency Dividing
Counting	Sampling
Gating	Coding
Multiplexing	Timing
Modulating	Matrixing
Cascading	Oscillating

While some of these functions "overlap" and are somewhat redundant, they are all included as each has individual features worth emphasizing and recognizing. In all these applications the useful pentode output of the beam switching tube may be put to work.

The Beam Switching Tube is so versatile that it can operate from voltages as low as 12 volts. A new low voltage production version of the Beam Switching Tube, known as type 6701, is now available. This tube is both compatible and competitive with transistors. In addition to replacing the equivalent of as many as 2[illegible] transistors or more, this low voltage Beam Switching Tube has basic advantages over transistors, as follows:

1. High impedance input
2. Constant current output
3. High temperature operation
4. B plus efficiency inherently superior to that of transistors.
5. 1 MC operation at considerably lower cost
6. Reproducibility

The Beam Switching Tube is establishing itself as a reliable 50,000 hour vacuum component. This, in conjunction with its ability to withstand severe shock and vibration tests, has resulted in its application in many missile projects.

As these descriptions indicate, and experience has verified, the beam switching tube represents a considerable departure from standard receiving tubes. It should be appreciated that the engineering know-how in applying these tubes is very specialized, nearly as specialized as that needed in the transition from vacuum tubes to transistors.

It is of historic interest that the ancestry of beam switching tubes can be traced back to the earliest days of vacuum technology to when A. W. Hull did his original magnetron experiments in 1921. Observations of the formation and control of discrete beams in split anode magnetrons were noted as early as 1938. The Royal Institute of Technology, Stockholm, Sweden and the Ericsson Telephone Company of Sweden have worked on beam switching tubes. Further developments and improvements in the tube and its applications have been made by the Burroughs Corporation at the Burroughs Research Center, Paoli, Pennsylvania. The inventor of the MBS tube is Saul Kuchinsky of Burroughs

The versatility of a "basic position" was recognized and components embodying this principle have gone through the stages of pilot production and mass production without publicity. Most devices, either potentially successful as the transistor, or even unsuccessful ones, are usually well publicized before their technology is advanced to the practical stage. Here is a refreshing challenge which is a promising exception to the rule.

OUT OF THE BRIEFCASE

METALS PILOT PLANT

A new metals pilot plant designed to answer the need for new alloys has been opened by the Westinghouse Electric Corporation at Blairsville, Pennsylvania. The $6,000,000 facility combines under one roof essentially all types of metal processing equipment.

Making the final link in Westinghouse's metallurgical development facilities, the 173,000 square foot

plant is designed to process both wrought and cast alloys with equipment flexible enough and large enough to allow actual manufacturing conditions. Thus, the Blairsville plant can uncover problems that can only be found under actual manufacturing conditions.

Advanced design in steam and gas turbines, generators, nuclear power reactors, etc. necessitates development of new metals having better temperature, strength, and magnetic characteristics. New titanium, molybdenum, expansion and resistance alloys show special promise. Further development of special alloys such as Discaloy, Refractaloy, K-42-B, Hipernik, Hiperco, Hipersil, and Kovar is specifically planned.

LOW TEMPERATURE

Low temperature research at the Bureau of Standards has resulted in alignment of the nuclei of three radioactive elements: cerium-139, cerium-'41, and neodymium-147.

Samples of these three were cooled to within a few thousandths of a degree of absolute zero. At such a low temperature the effects of thermal agitation become so small that atomic nuclei can line up in a given direction within the crystal lattice. A corresponding directional effect can then be observed in the emitted radiation.

If the nucleus is radioactive, the orientation of its spin axis will determine the directions in which the nucleus emits radiation . Normally, when nuclei are randomly oriented, a radioactive specimen will emit gamma rays with equal intensity in all directions. However, when the nuclei are aligned, the intensity of gamma radiation varies with angle of emission.

By measuring the degree of this directional effect, valuable information can be obtained concerning the decay scheme of the nuclei, and an insight can be gained into the mechanisms controlling the processes of nuclear disintegration.

LATENT IMAGE STUDY

A new approach to probing secrets of the latent image, the unseen picture that exists on photographic film after the shutter clicks but before development, has been made by the Eastman Kodak Company.

In the new method, simultaneous pulses of light and electricity are supplied to a silver halide crystal. These crystals are part of the light-sensitive coating on some photographic films. Electricity is discharged lasting a millionth of a second, giving 5,000 volts across the crystal. Light is supplid from a pressure mercury arc. Due to the extreme brevity of the exposure and voltage pulses, photographic scientists can, for the first time, study the motion of electrons in the crystal.

One important feature of the experiments so far is that latent image formation follows the movement of electrons, as shown by the displacement of the latent image to one side of a large crystal when the electrical field drew electrons in that direction.

This new knowledge of the latent image is expected to aid in work on better photographic emulsions and in research on specialized photographic materials and equipment.

HOTTEST SAFE—Highly radioactive canned uranium is stored in a safe that works like many soft drink dispensers. Samples hang from five steel disks located below floor level that are positioned by hand wheels at right to bring them into position for removal. Used at the Hanford, Washington, Atomic plant operated by General Electric for the AEC, the safe keps radioactivity from scaping into the plan't metallurgy laboratory.

THE VANGUARD

The Vanguard three-stage rocket vehicle, being designed and built by Martin Company of Baltimore, under Navy management, will be the first liquid fuel rocket designed to be controlled without the use of fins.

The rocket will deliver the world's first man-made satellite to its orbit established approximately 300 miles above the earth.

The first stage rocket, about 45 feet long, is very like the Navy Martin Viking research rocket which attained an altitude of 158.4 miles, record for a single-stage rocket. The second stage rocket, mounted above the first stage, has a cone shaped nose section, and also uses liquid propellants. The third stage rocket, with the satellite attached to its nose, will be carried completely enclosed within the second stage rocket. The third stage, because of its simplicity, uses a solid propellant.

The first stage, which launches the entire assembly, will burn out its fuel at an altitude of between 30 and 40 miles at which time it will separate and drop off.

The second stage will start firing and at a certain time expose the third stage and the satellite. The second stage rocket will tilt in the direction of the satellite's predetermined flight path, continuing to coast upward after its burnout until it attains the satellite's intended orbital altitude.

This stage will drop off and the third stage will start firing.

Its job is to boost the satellite's speed to approximately 18,000 miles per hour. This third stage rocket has no guidance system to direct its flight. The high speed necessary to counteract the earth's gravitational pull will be attained at the rocket's burnout, whereupon the satellite may be shoved ahead by means of a releasing device in the nose of the third stage rocket. Thus, the satellite speed will be slightly greater than that of the rocket shell, which won't drop to earth but will trail the satellite until atmospheric drag causes both to slow down and gradually spiral toward a lower atmosphere.

Through friction induced by passing into this denser atmosphere, both the satellite and rocket will burn for a brief time and then disintegrate after the manner of meteors.

FALLOUT STUDY

The National Bureau of Standards has developed a special purpose computer to give the geographic fallout pattern of radioactivity after a nuclear explosion. Given pertinent information about the bomb and extant weather, this analog computer will assist in predicting what the distribution and intensity of radioactivity will be on the ground after the bomb has been detonated.

Several assumptions, based on past experience, simplify computing of fall out and have been incorporated into the design of the computer. One assumption is that wind distribution is constant both over the entire fallout area and during the fallout period. Wind vertical components are neglected. The explosion's mushroom cloud is assumed to have a circular cross section that varies with height in some specified manner. Within the cloud is a distribution of particles of varying size and radioactivity. At any given height this distribution is assumed to be uniform and to have circular symmetry. A further assumption is that no diffusion occurs during fallout, so that particles originating within any specified layer of the cloud maintain their relative positions.

Artist's Conception of Vanguard Missile Launching

—Martin Photo

NUCLEAR FUEL

Nuclear fuel to lower costs of electricity has brought about a new type of experimental atomic energy reactor, designed by Atomics International, a division of North American Aviation, for the Atomic Energy Commission. The reactor will be built at the AEC's National Reactor Testing Station in Idaho and should be completed late this year.

This small experimental reactor is known as the Organic Moderated Reactor Experiment (OMRE), and will cost a total of $1.8 million. Atomics International is assisting the program by bearing over $750,000 of the expenditure.

An organic material, carbon-hydrogen compound, will play "moderator-coolant" in the reactor system. As a moderator, the compound (e.g. diphenyl) "slows" neutrons produced in the atomic fission process, to help sustain the chain reaction. As a coolant, the material, in liquid state while the reactor is in operation, will circulate through the reactor core where heat from the fission process will be "soaked up" and carried outside to heat exchangers.

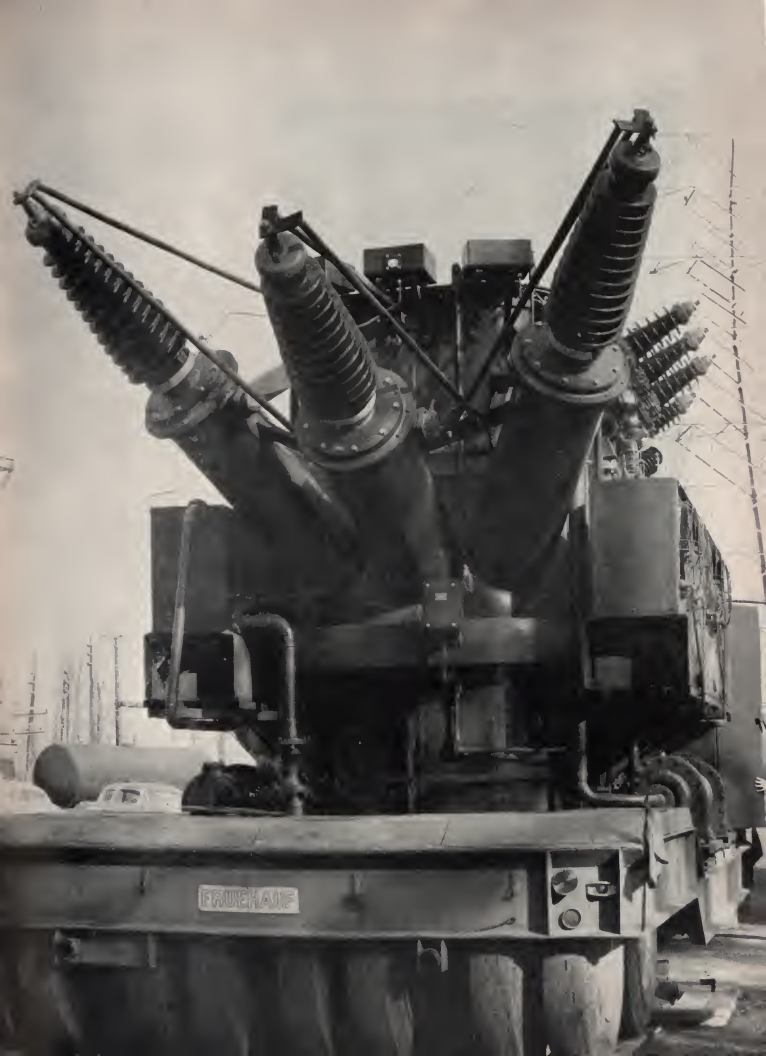
Approximately 16,000 kilowatts of power in the form of heat will be produced by the reactor. As the experimental program is concerned only with technologies of the reactor itself, it is not planned to convert this heat into electricity.

Not a Martian about to blast through the floor, or a scene from a science fiction movie is this weird creature. He is, however, a radiation-proofed walking radio transmitter used to report radiation intensity in a "hot" zone. *General Electric Photo.*

The main projects concern the effect of heat and radiation on the organic coolant. They tend to cause the liquid to deteriorate. The primary purpose of OMRE is to determine the irradiation and thermal stability of organic coolants under conditions found in a prototype power reactor.

The organic moderated reactor approach to economical nuclear power is promising for plants of small capacity.

LARGEST ON WHEELS—Believed to be the largest portable transformer ever made, this giant was built by General Electric for the Louisville Gas and Electric Co. Forced-oil, forced air-cooled unit has four windings for connection to circuits of 138,000 volts, 37,000 volts, 14,000 volts or any combination thereof. It is designed for emergency service or where maintenance work is needed. The 25,000-KVA transformer is 11 feet, eight inches wide, and 15 feet high, can supply needs of city of 60,000 people.


FRUEHAUF

HIGHEST SEARCHLIGHTS

Northeast skies will be set aglow with the installation of four mighty searchlights to the world's tallest building. Set just above the observation platform of the Empire State Building, 1,092 feet above New York City streets, these can be seen under ideal conditions as far as away as Boston and Baltimore.

Manufactured by the Westinghouse Electric Corporation, the 2,500-watt short-arc mercury lamps, aided by highly polished reflectors, will produce 450,000,000 candle power of light her beacon. Combined, the four beacons provide almost two billion candle power of light, reported to be the brightest continuous man-made source of light.

The searchlight units, originally carbon arc lights, were used as anti-aircraft searchlights during World War II.

Temperatures within the searchlights range as high as 1500 degrees Fahrenheit. To withstand these extremely high temperatures, the bulbs are made of quartz rather than glass. The quartz is also required because of the high internal pressures of more than 300 pounds per square inch.

One of the five-foot beacons will point straight up. (See illustration.) The three others atop the Empire State Building will be directed outward at an angle of five degrees above the horizontal. They will revolve counterclockwise at the rate of one revolution per minute from sundown to midnight.

SMOG STUDY

Los Angeles has perhaps the most publicized smog in the United States today. It also seems to have more projects to alleviate this air pollution. The Air Pollution Foundation has launched another stepped-up research drive to find out what must be done to automobile exhaust in order to cut down the eye irritation in smog.

The principle constituents of exhaust gas, water vapor, carbon dioxide, and carbon monoxide, have no known relation to smog, but hydrocarbons (unburned fuel) and nitrogen oxides are smog's most probable causes, according to Dr. Hitchcock, Foundation president.

Among questions to be answered are:

1) Will a reduction of hydrocarbon emissions alone be sufficient?

2) If so, how much of a hydrocarbon reduction will be necessary?

3) If not, what must be done about the other smog-forming pollutant known to come out of auto tail pipes — nitrogen oxides?

In Kansas City, work is being expanded on a research project started by the Foundation last year. Auto exhaust will be pumped into a 5000 cubic-foot greenhouse and exposed to sunlight from morning until night. The exhaust flow of hydrocarbons and nitrogen oxides will be adjusted to the same concentrations as those measured in Los Angeles atmosphere. A human panel should then experience eye irritation of the same type as in Los Angeles on a smoggy day. And in late afternoon and evening the irritation should disappear.

By varying the amounts of each contaminant, it is hoped to determine the effect of decreasing either hydrocarbons, nitrogen oxides, or both. Scientists may slug the greenhouse with auto exhaust between 6 and 8 A. M. to duplicate heavy morning traffic, then reduce the flow and slug it again between 4 and 6 P. M. to note the effects.

In the Pasadena laboratory, auto exhaust will be mixed in a chamber with purified air, from which all Los Angeles Basin pollutants are removed.

CAMPUS NEWS

SIGMA TAU

April the twenty-first will long live in the memory of some of the members of Xi chapter, for it was on this day that the improbable happened: the graduate record exam fell on the same day as the semi-annual banquet and ball. After staggering out of the exam rooms at five-thirty, the senior members and their less fortunate junior brothers convened at the Cloud Room of the National Airport for the spring initiation banquet and ball.

Ten newly initiated members gave their version of a newly-formed dishonor society, "Phi Beta Fumble" in the traditional skit.

ASCE

In an April meeting at College Park, Maryland, the Washington and Maryland section of the Student Chapters of the A. S. C. E. heard Timber Engineering Company's representatives in an evening devoted to timber engineering. The joint program brought together students, faculty members and guests of George Washington University, Howard University, John Hopkins University and the University of Maryland Student Chapters. The program was presented to acquaint the students with timber engineering, which is given only a light treatment in the classroom.

In an afternoon section of the conference, the assembled civil engineers had the opportunity to visit TECO's laboratory in northeast Washington. Speakers in the field of timber engincering covered many phases of the field, including new uses and applications for what was formerly considered waste products.

The highlight of the entire conference was the testing of a full scale forty-foot timber truss and a smaller house truss.

AIEE - IRE

The student branch of the AIEE-IRE was privileged to have two of the year's outstanding speakers address them at their last meeting of the 1955-1956 school year on May 2.

Mr. Emerick Toth of NRL discussed "Radio Receiver Design Considerations." Now that we have advanced beyond the radio to television, we lost sight of the complexity of the problems facing the early audio experimenters. As we know, the problems were solved and the basic circuits still remain an important part of television and F-M sets.

Mr. Cullen Pearce, of the Westinghouse Electric Corporation and Vice President of the AIEE outlined the various fields that an engineer can be expected to participate in upon graduation. His talk was very interesting and most timely as graduation nears for many of us.

Elections were held and the officers were elected for the 1956-1957 school year.

The meeting closed with the serving of an excellent lunch and the recitation of a prayer - - "Please help me pass EE 148."

Pi DE ELECTIONS

Three MECHELECIV staff members were elected to official posts in Pi Delta Epsilon on April 19. Associate Editor Ray Sullivan will fill the post of Vice President, while Office Manager Vince Rider will serve as Treasurer. Staff writer Bobby Holland will be the Historian for the coming year.

Pi Delta Epsilon is an honorary journalism fraternity, open to members of both the business and editorial staffs of campus publications.

(Please turn to page 32)

A shot of Tompkins Hall showing siding being secured

Barwick Photo

VAN EVERA RECEIVES AWARD

The 1956 Honor Award of the Washington Chapter, American Institute of Chemists, was presented to Dr. Benjamin D. Van Evera, FAIC, Coordinator of Scientific Activities and Professor of Chemistry at the George Washington University on Tuesday, April 24 at a dinner meeting at the Tally-Ho Restaurant. Dr. Van Evera received the award in recognition of his effective contributions to the field of chemical education, both as a teacher and an administrator.

ODK TAPS

Omicron Delta Kappa tapped engineering Dean Martin A. Mason as a faculty member and Mecheleciv Editor M. Michael Brady as a student member at the May Day ceremonies in Lisner Auditorium. O. D. K. is an honor society recognizing outstanding leadership on the University campus, and claims many faculty members in its roster.

Dean Mason's contributions to the University are familiar to all engineering students. He is an alumnus of the university, having received a B. S. in Engineering in 1931. After successfully completing a graduate program at the Bureau of Standards and Johns Hopkins University, he was awarded a John R. Freeman scholarship which made it possible for him to continue his graduate work in the field of hydraulics at the University of Grenoble in France. During World War II he served as Chief of the Research Section of the Army's Beach Erosion Board. Dr. Mason taught proseminars in Mechanical Engineering at G. W. from 1941 to 1944, and became Dean of the School of Engineering in September of 1951. He is a member of A.S.M.E., A.S.C.E., the American Geophysical Union, and Sigma Tau.

Mike Brady, editor of the 1955-56 Mecheleciv, is a senior with a major of communications in Electrical Engineering. In addition to having worked on Mecheleciv for three years, he is a member of Sigma Tau, Theta Tau and Pi Delta Epsilon. He has served as secretary of the A.I.E.E. - I.R.E. and engineering editor of the Cherry Tree. He was also elected to "Who's Who Among Students in American Colleges and Universities" along with Engineers Council President Sam Mawhood, and has served on the Engineers' Council since 1954.

UNQUOTABLE QUOTES

Assume an elephant—color: pink—mass: 2,007 tons—to be sliding down an inclined plane with the same velocity as a soft boiled egg in a vacuum. Tied around the elephant's waist is a rope. One end of the rope passes over a pulley at the top of the plane, from which two deaf Indians hang. The Injuns, Homer Smith and Henry Splash-in-the Diode Jones, are climbing up the rope at the rate of 286.9 Gormleys per second. The effective frontal area of the proboscedian is 4 square coulombs. The coefficient of cold sliding friction being .0076 light years, how long would it take for a 65 M solution of rotten eggs to become scrambled at the base of the plane? Assume the derivative of the elephant to be constant.

An old maid, shocked at the language of some ditch diggers working near her home, complained to their foreman. The foreman promised to inquire into the matter and called one of the men over.

"What's all this about profane talk?" he demanded.

"Why, boss," replied Joe, the ditchdigger, "It's nothing at all. Me and Butch was working there, side by side, and I accidentally let my pick slip and it hit him on the head. And Butch looked at me and said, 'Now really, Joseph, in the future you must handle that implement with more caution.'"

At David Sarnoff Research Center, Princeton, N. J., RCA tests one of loudspeakers used in new high fidelity "Victrola" phonographs.

BALANCING

(Continued from Page 11)

which pick up and transmit vertical movement of rollers, an electronic unit with controls for changing the characteristics of the machine, meters which show the degree of unbalance and rotational speed and a stroboscopic lamp.

The shaft is placed on the rollers and a cralk mark is made on each end in the same positions to the crank's axis. Then the shaft is rotated and higher speeds are not necessary, since the critical speed is usually less than 1,000 rpm. If the shaft is in balance at the critical speed, it will be in balance at all others. Then the motor is cut and the shaft begins to decelerate and the "strobe" light is flashed on and the amount of unbalance is read on the machine's meter as the critical speed is being passed. The reading on the unbalance meter is noted at this time and the location of the unbalanced forces in the shaft is ascertained by the position of the chalk mark when the lamp flashes.

A *stroboscopic lamp* is an electric lamp capable of producing a bright flash of light of very short duration. By utilizing movement of the work supports on the machine to actuate it, the lamp will, for a certain condition of unbalance, always flash when the object on the supports reaches a certain position during each revolution. The light, on the object, seems to be stationary because it is flashing the same number of times per minute that the object is rotating.

Also, the static balance can be checked on the machine. When in motion, static balance becomes "kinetic" balance and this is easy to determine since motion magnifies the unbalance. But, "kinetic" and "dynamic" unbalance reach their peaks at different speeds and can be easily distinguished. A machine circuit must be changed to read one or the other. For kinetic balance, the strobe light flashes when the heavy side of the shaft is in the lowest position. For the dynamic setting, the light flashes when the heavy side of one end is up and the heavy side of the other end is down. Now, if the machine is on kinetic and the light shows the chalk mark to be above the axis of the shaft and in a vertical position, the operator knows that the heavy side for that end is directly opposite the chalk mark. When the heavy side is located, the crankshaft is lightened on that side by drilling holes in the counter-weights or grinding the shaft's surface. Then the shaft is rebalanced and machined until perfect balance is obtained.

4. *Balancing*: *Flywheels*—Flywheels are mounted on special mandrels with a mounting flange and balanced by the chalk mark method, using the strobe lamp. A method of adding known weights and drawing a force vector diagram is more time consuming and less accurate than this method. Flywheels can then be drilled to balance them.

(Please turn to page 38)

A L U M V I E W S

PRESIDENT'S MESSAGE

By Warren C. Crump
President, Engineers' Alumni Association

The month of May is probably the most important in the history of the Engineer Alumni Association. It is during these days that graduates of the School of Engineering are in growing numbers investing in the continued greatness of The George Washington University.

This investment is being made through the 1956 Alumni Fund in which members of the Association are playing an extremely active part. Your President, as National Chairman for Engineering graduates, has been more than gratified at the response of our fellow Engineering alumni to the Fund and more specifically to the equipping of Tompkins Hall, the new home of the School.

What has meant even more to the future of our Association, is the time and effort being employed by nearly 100 volunteer workers who are making personal contacts with fellow alumni in the Washington Metropolitan Area. Our sincere thanks go to these men and best wishes for their success.

You who have not contributed, of course, will determine the success of this year's Fund effort which ends June 1. Let's put the School of Engineering at the head of the list of contributors and contributions!

To celebrate this very active year, the Engineer Alumni Association will hold its annual luncheon meeting on Saturday, June 2nd, at 12:30 p. m. in the Burlington Hotel. An outstanding program is being arranged. It should make a wonderful reunion for all alumni of the School of Engineering.

Since this is my last opportunity to present my thoughts to you as President of the Engineer Alumni Association, I want to say that it has been a great honor for me to serve the organization during the past year. My thanks go to all my fellow officers who have unselfishly given their time to meet with me in the planning of our activities. I think the interest shown during the past twelve months is indicative of a stronger Engineer Alumni Association in the years to come.

ALUMNI NOTES

By the Alumni

Henry J. Leinbach, Jr. (*BEE* '48) is still working with the Sound Section of the Bureau of Standards in architectural acoustics. He is working for a Masters degree in Physics and is still a bachelor. As a hobby, transportation is his interest.

Lloyd L. Smith (*BSEE* '05) received his MSCE from the University of Wisconsin in 1907. Mr. Smith has had wide experience in construction and has worked as a manufacturer's representative for 20 years. He has a son, Lloyd L. Smith, Jr., who is an associate professor at the University of Minnesota teaching graduate students.

William F. Roeser (*BS in EE* '25, *MA* '29, *Sigma Tau*) is the chairman of the Alumni Advisory Board at George Washington University. Mr. Roeser has left for Australia to participate in meetings of the Directors of Building Research of the British Commonwealth. During his stay in Australia, he will visit laboratories and building research projects.

R. W. Beatty (*BS in EE* '39; *Sigma Tau, Theta Tau*) is working for the Bureau of Standards in Boulder Colorado as the Chief of Microwave Circuit Standards Section of the Radio Standards Division. He is presently attending the University of Colorado where he is studying physics. He has a daughter, Cherry, who is five years old.

TO: ALUMNI EDITOR
Mecheleciv Magazine
The Davis-Hodgkins House
The George Washington University
Washington 6, D. C.

From: ------------------------------

Here are a few comments for ALUMVIEWS on where I'm working, what I'm doing and news of my family.

Degree and Date ------------------------------ **Fraternity** ------------------------------

THANKS!

MECHELECIV wishes to thank the following alumni who have subscribed since the March issue. Additional subscriptions will be acknowledged on this page as they are received.

Alexander, Robert T.	*Va.*
Allen, Thomas K.	*Ind.*
Ball, Eugene M.	*Ark.*
Bassett, Ellsworth W.	*Va.*
Bauer, Hugh B.	*D. C.*
Beatty, Robert W.	*Colo.*
Barsis, Albrecht P.	*Colo.*
Black, Joel C.	*Maine*
Burns, Robert S.	*Va.*
Cavanagh, Thomas E., Jr.	*Ill.*
Copeland, Alfred	*Va.*
Caffes, Peter J.	*Md.*
Davis, Donald V.	*Penna.*
Czajkowski, Norman	*Md.*
Dawson, James, A.	*Calif.*
Degnan, George A.	*D. C.*
Dimmette, Claude C., Jr.	*Md.*
Drysdale, James M.	*D. C.*
Dovener, Robert F.	*Fla.*
Dutton, Col. Donald L.	*Del.*
Falco, Maceo, Col.	*Ariz.*
Folse, Kenneth H.	*D. C.*
Freeman, James T.	*D. C.*
Geyer, Wallage T.	*N. Mex.*
Given, Roland	*Mich.*

ALUMNI NOTES

(Continued)

Captain J. A. Hartman, USNR (*BME '40; Sigma Tau, Theta Tau, Omicron Delta Kappa*) has attended the National Resources Conference held in Savannah. Georgia, March 12-23. He reports that five hundred representatives from the Air Force, Army, Marine Corps, Navy, Coast Guard and selected civilian personnel were present.

Harry J. Tucker (*BEE '51; Phi Sigma Kappa*) is the Project Engineer on the Sonar Engineering Section of the Heavy Military Electronic Equipment Department of the General Electric Co. His family includes his wife, Annabelle, sons Steven 5 and Russell 3, and daughter Kathryn 4 months.

Captain Robert T. Alexander (*BSE '52, MS in Physics '40*) is working as Chief of Civil Engineering Division, Office of Engineering, US Coast Guard Headquarters in Washington, D. C.

Golden, Leopold	*N. J.*
Goulden, Paul V.	*D. C.*
Hallquist, Norman J.	*Md.*
Houck, David	*Mich.*
Johnson, David P.	*Va.*
Karayianis, Konstantinos	*D. C.*
Leinbach, Henry J., Jr.	*D. C.*
Levin, Alexander	*Mass.*
Lipowsky, Frank J.	*Md.*
Lloyd, Harold L.	*W. Va.*
Johnson, Roger C.	*Ill.*
Michelson, Charles J.	*Ohio.*
Magruder, Oliver G.	*D. C.*
Mainhart, Howard M.	*Md.*
McCalip, Curtis E.	*Va.*
McCarthy, Daniel J., Jr.	*D. C.*
McKnight, Merwyn N.	*Va.*
McLaurin, Turner S.	*Va.*
Muth, Raymond F.	*Pa.*
Nicolaisen, Gordon A.	*Md.*
Osborne, Phillip W.	*Oreg.*
Parks, Albert B.	*Md.*
Pendergast, Edward H., Jr.	*W. Va.*
Pendergast, Joseph P.	*Ohio.*
Quinn, Brent M.	*Md.*
Rixse, George E.	*Mass.*
Roettiger, Henry A.	*Va.*
Saum, Irving R.	*Md.*
Schaffer, Paul S.	*Md.*
Thomasson, Harold B.	*Va.*
Tucker, Harry J.	*N. Y.*
Urbine, Charles A.	*Va.*
Wallin, Edward J.	*Va.*
Wheeler, Harold A.	*N. Y.*
Wiest, Quentin W.	*Ill.*
Woodsome, Orville C.	*Md.*

Vault of the Future

At a time when the present seems most important, plans for the knowledge of future generations are being made in the engineering plant of G. W. U. A vault for the future, containing examples and knowledge of engineering in 1956, is to be dedicated early this summer. The vault, to be opened in 2056, will contain twenty-four copper boxes which will be filled by various engineering organizations.

The boxes are copper, with a bronze plate on each with the name of the contributor. Their dimensions: 8" deep x 12" wide x 18" long. The vault itself will be centered in the middle of the walk from 23rd Street to the Main Entrance of the Hall of Engineering, halfway between the steps to the front door and the steps leading to the sidewalk level. It will be concrete lined and extend to a depth of 21 feet.

The copper boxes will contain evidences of special projects, engineering artifacts which demonstrate the standards and practices of engineering in 1956. Included in one of the University boxes will be records and examples of the life and work of engineering students of the University in 1956.

The contributors to the vault are as follows:

Board of Commissioners, District of Columbia
United States Atomic Energy Commission
Department of the Air Force, United States of America
Department of the Army, United States of America
Department of the Navy, United States of America
National Advisory Committee for Aeronautics
National Bureau of Standards, U. S. Department of Commerce
American Institute of Electrical Engineers, Washington, D. C. Section
American Society of Civil Engineers, National Capital Section
Americal Society of Mechanical Engineers, Washington, D. C. Section.
American Institute of Mining & Metallurgical Engineers, Washington, D. C. Section.
District of Columbia Society of Professional Engineers, Inc.
Institute of Radio Engineers, Inc.
Society of American Military Engineers
Chemical Engineers Club of Washington
Washington Society of Engineers
Faulkner, Kingsbury & Steinhouse, Architects
Charles H. Tompkins Company, Builders
Society of Women Engineers
National Academy of Sciences & National Research Council
The George Washington University

The contents of the boxes will, naturally, be quite varied. For example a partial list of the contents of the A. S. M. E. box would include: strain gauges, precision ball bearings, turbine blades, a Minneapolis-Honeywell HIG gyro, and several five-and-dime commercial items such as a stapler and a ball-point pen.

Charles H. Tompkins — The Man

When Charles Hook Tompkins was given the honorary degree of Doctor of Engineering in February 1946 from the George Washington University his citation read: "A son of Maryland and member of the Lehigh and George Washington Universities; efficient engineer and accomplished builder; following through an honorable career of genuine business activity and admirable public service. For 20 years . . . a real friend to this University." The whole life and works of Mr. Tompkins testify to the truth of this citation.

He was born in Baltimore, Maryland in 1883. He attended Lehigh University from 1903-1904 and in 1905 entered the School of Engineering of the George Washington University. He went to night classes while working during the day. In 1911 he began work as a construction engineer under his own name and in 1922 he organized the Charles H. Tompkins Company, the biggest construction company in the metropolitan area today.

In 1952, Mr. Tompkins was elected to the board of Trustees of the University which he has served so well throughout his life. Besides currently building the new Tompkins Hall of Engineering, the Tompkins company has constructed all of the University buildings since 1934, including the Hall of Government, Monroe Hall, Lisner Library, the Hospital, and Lisner Auditorium. He has also done buildings for the Georgetown and American Universities.

In October 1953, Mr. Tompkins was one of seven men appointed to a special committee to advise Engineer Commissioner Louis W. Prentiss on major issues confronting the National Capitol Planning Commission. In addition to the buildings of Washington, which stand as monuments to this one man, air force bases, apartment projects, and power, flood control, and reclamation projects from Texas and Utah to Tennessee and New York bear the mark of his extraordinary ability.

Besides his business career, Mr. Tompkins is one of the civic leaders of the District of Columbia.

GRADUATE STUDY

(Continued from page 7)

the purposes desired. This reputation reflects the caliber of the faculty, educational philosophy, and methods. The quality of graduate education may be independent of the quality of undergraduate programs, so should be judged separately. Furthermore, a distinction must be made between a school which turns out an excellent product with an average program largely because it attracts the best students, and one which achieves a high level through excellent programs and methods.

The choice of a school is, at the least, a bilateral matter, since most schools are selective in admitting students. To a considerable extent, selection is based upon undergraduate scholastic achievement and faculty recommendations as criteria of potential for success in graduate study. The undergraduate whose career may depend upon graduate study will be wise to recognize this in his viewpoint toward performance in undergraduate studies. Although admission committees may recognize that perfomance is the product of ability and motivation, the individual with an established performance record is less of a risk than one with a poor record irrespective of possible improvement in motivation.

If the career development plan and available graduate study programs show a need and means for meeting the need, then, graduate study will probably bring rich returns for all the effort and sacrifice involved. The expense in time and dollars should not be minimized even though not discussed here. The rewards are seen in higher salary, more challenging and interesting work of a desired type, advancement in professional stature, and the intellectual satisfactions of deeper understanding and increased competence.

BALANCING

(Continued from page 34)

5. *Balancing: Clutch Pressure Plate and Assembly*—These are bolted on to their own balanced flywheel and given the chalk and lamp test. Material can be removed from bosses which project up through the coils of the pressure plate springs. Marks should be made on the pressure plate cover and flywheel so that the P. P. assembly will be mounted in exactly the same position after balancing to eliminate misalignment. This is very important. The crankshaft pulley and vibration damper should also be mounted on their respective crankshafts and checked for balance.

The mechanical advantages of balancing should now be apparent. Engine life is extended, smoother operation is obtained and short-term maintenance is cut down. Rebuilt engines invariably should have a balancing test because in the rebuilding processes, material is removed from the surface of parts.

Someday, factory fresh cars may feature balanced engines but at the present production rate and with little demand for a long life car, as was made in the prewar day, it seems that the individual will have to seek his own balancing shop. Internal Combustion Engine Balancing is a big step to finer engines.

MECH - MISS

FOR MAY

(Editor's Note) Through its recent evaluation of itself, Mecheleciv has found that its students, as well as many of its alumni readers wished some light treatment of engineering as reading matter. With the March issue, the Slipstick Slapstick department was born; it has received the greatest readership of any department since it was first published. Since readership, to some extent, determines the content of Mecheleciv, this page has been dedicated to our readers. With tongue in cheek, Mecheleciv presents its topic for May: Marine Enginering.

Specie	*Homo sapiens*
Genus	*Female*
Nomenclature	*Pat Stanner*
Association	*Chi Omega*

Important characteristics (M.K.S. System)

Weight 50*kg*
Height: 1.6 *meters*
Usual Dimensions: 0.863, 0.559, 0.890 *meters.*
Age: (*in years*) 19.50

Other useful data:

Pat is a Freshman in the Junior College doing her work in Pre-education with a Spanish Major. Like many co-eds at G. W., Pat hails from Washington.

Photograph by Tom Beale

ELECTION RESULTS

ENGINEERS' COUNCIL MEMBERS

Open Election

Senior	Joe Greblunas
Senior	Anthony Lane
Junior	Mickey Boothe
Junior	Jerry Renton
Sophomore	James Somervell
Sophomore	Charles Watts

Organization Representatives

IRE	Warren Crockett
ASME	Howard Davis
ASCE	Walt Evans
Theta Tau	Dick Rumke
Sigma Tau	Dan Palmasani
House Manager	Norm Street
Mecheleciv	Vince Rider

THETA TAU

Regent	Earl Reber
Vice Regent	Tony Lane
Scribe	Dick Rumke
Assist. Scribe	Ray Sullivan
Treasurer	Howard Davis
Assist. Treasurer	Sy Matthews
Correspondence Secretary	Reg Charlwood
Marshall	Francis Mikalauskas
Inner Guard	Joe Greblunas
Outer Guard	Dave Lewis

SIGMA TAU

President	Irv Shick
Vice President	Herb Carlson
Treasurer	Saul Myers
Recording Secretary	C. Ullschafer
Corresponding Secretary	Art Wedler
Historian	Damon C. Gray
Faculty Advisor	Prof. Cruickshanks

A.I.E.E. - I. R. E.

Chairman	John Manning
Vice Chairman	Albert-André Pinto
Local Secretary	Bob Knowles
Treasurer	Roy Brooks
AIEE Corresponding Secretary	Bob Keith
IRE Correspondence Secretary	Charles Smith
Faculty Advisor	Prof. Hanrahan

A.S.M.E.

Chairman	Bill Mulkey
Vice Chairman	Dave Lewis
Secretary	Orron Kee
Treasurer	Frank Ryerson
Faculty Advisor	Prof. Greeley

A.S.C.E.

President	Dick Rumke
Vice President	Joe Scott
Treasurer	Dan Dreyfus
Corresponding Secretary	Davis Halsey
Recording Secretary	Richard Haefs
Faculty Advisor	Prof. Walther

MECHELECIV

Editor	Ray Sullivan
Associate Editor	Jerry Renton
Business Manager	Vince Rider

Build your future on these 3 Growth Industries . . .

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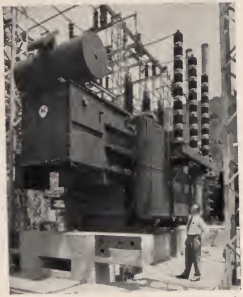
CONSTRUCTION—Crushers like these from Allis-Chalmers process the enormous quantities of aggregate for the booming construction industry.



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Slipstick Slapstick

A woman went to a doctor to complain about her husband's delusion. "It's terrible, Doctor," she said, "all the time he thinks he's a car door."
"Well," consoled the doc, "That isn't too bad. Quite a harmless delusion I'd say."
"The delusion I don't mind, Doctor. But when he sleeps with his mouth open, the little light keeps me awake!"

* * *

English prof: "Correct this sentence, 'Girls is naturally better looking than boys.'"
Wise frat man: "Girls is artificially better looking than boys."

* * *

If it takes 10 hours for a woodpecker with a rubber bill to chop $65 worth of shingles from an oak tree, how long does it take a grasshopper with a wooden leg to kick the juice out of a dill pickle?

* * *

He only drinks to calm himself.
His steadiness to improve.
Last night he got so steady,
He couldn't even move.

* * *

A shipwrecked sailor was captured by cannibals. Each day the natives would cut his arm with a dagger and drink his blood.
Finally he called the king: "You can kill me and eat me if you want," he said, "but I'm sick and tired of getting stuck for the drinks."

* * *

We point with pride to the purity of the white spaces between our jokes.

* * *

"You look very downcast."
"Yes, my wife has been away for six weeks and I wrote her every week and said I spent the evenings at home."
"Well?"
"She's back now and the light bill has come in—it's for 50 cents."

Prof: "Young man, are you cheating on this exam?"
Student: "No, sir. I was only telling him that his nose was dripping on my paper."

* * *

"What's the hurry?"
"I bought a new text-book and I'm trying to get to class before the next edition."

* * *

The young, inexperienced druggist was left in care of the store while the owner went on an errand.
After he had been there a while, the young pharmacist went to wait on a young lady who was in the throes of a bad coughing fit.
"Please," she said, "you've got to give me something for this terrible cough."
"I've got just the thing for you," said the young man. "Just come with me." Soon after the owner returned and asked how business was.
"Fine," he said. "I just cured a lady's cough."
"Good," said the old man. "How did you do that?"
"Well," he replied, "I gave her a malted and in it I put 4 oz. of mineral oil and 5 oz. of caster oil."
"Great guns, man," he replied. "that won't cure a cough."
"Oh, no?" said the young man. "Look across the street. She's leaning on that lamppost and she doesn't dare cough."

* * *

God made a machine, the machine made men,
Doctors, lawyers, priests, and then
The Devils got in and stripped the gears
And turned out the first bunch of engineers.

* * *

Little boy watching milkman's horse: "Mister, I bet you don't get home with your wagon."
Milkman: "Why?"
Little boy: "Cause your horse just lost all his gasoline."

Engineer: "Going around with women a lot keeps you young."
Second Engineer: "How come?"
Engineer: "I started going around with women when I was a freshman two years ago, and I'm still a freshman."

* * *

A woman riding on a trolley car was anxious not to pass her stop. She poked the conductor with her umbrella and asked, "Is this the First National Bank?"
"No ma'am," he replied, "That's my stomach."

* * *

Curious fly
Vinegar jug
Slippery edge
Pickled bug.

* * *

One lady passenger on the train asked the porter to open the window next to her. "Otherwise, I'll suffocate," she said. The lady next to her protested, "If that window is opened, I'll freeze to death!" "What would you do, boss?" the porter asked a traveling salesman seated nearby. "Keep it closed for a while and suffocate the first one," muttered the salesman. "Then open it and freeze the other one!"

* * *

Three men were sitting on a park bench. The man in the middle was sitting quietly as though asleep. But the two men on either side were going through the motions of fishing. With deadly seriousness they would cast, jerk the lines gently, then swiftly wind their imaginary reels. This had gone on for some time when a policeman sauntered over, shook the man in the middle and demanded. "Are these two nuts friends of yours?"
"Yes, officer," replied the man.
"Well, get them out of here then."
"Right away officer," said the man as he began to row vigorously.

From The Editor's Notebook

When this issue was in the planning stages, it was quite evident that the work on it would run into final exam time. Even though some of the staff members (I'm not telling, but it's next year's board of editors) were knee deep in dynamics, they did a splendid job all along.

As the day draws extremely near when yours truly will leave his well-worn keys to the D-H house and the MECHELECIV Office to future staff members and head his car up twenty-second street for the last time, nostalgia becomes overwhelming. In the past year, MECHELECIV has almost doubled in size; all this would not have been possible without the cooperation, ideas and just plain hard work on the part of a truly good staff. Buried B. T. U.'s, Computers and Aircraft; Drawings, Jokes and Pin-Ups, it has been quite a three-year bout with the publishing game. Before this editor wanders out, there is a little gossip to be passed on. . . .

Paul O'Neil, whose article on the Draft appears in this issue, was heard to say (second hand, of course) that being married to a Mecheleciv staffer was sometimes difficult . . . . To be serious, though, Paul literally jumped at the chance to write the article, for which we are duly thankful.

Rumor has it that 55-56 council president *Sam Mawhood* ran afoul of the 14th street bridge with his brand-new Pontiac Star-Chief convertible. Sam's long looks aren't due to lab reports alone. . . .

Jack Brandau was, for a day, the envy of every senior on the engineering campus; Jack was in New York on the day of the graduate record exam. . . . said he was presenting an A. S. M. E. Prize Paper. We wouldn't have believe him if *Professor Cruickshanks* hadn't gone along too.

Upon seeing a coffee cup in the back of the Dean's office labeled "M. A. M.," y.t. queried if this meant "Marge Atlee's Mother," both *Marge Atlee*, who works as part of the Dean's crew and *Dean Martin A. Mason* thought it hilarious, although we haven't lost an editor yet. . . .

While wandering around Corcoran the other day, y.t. peeped in the power lab to see *Professor Norman B. (Deacon) Ames* seemingly surveying the lab with fondness. . . . we know, Deacon, thirty-five years is a long, long time. To your years here, and to you, we offer only thanks and admiration.

There is, at this point, no "In Our Next Issue" department. Here this editor will merely present the new board of editors: *Ray Sullivan*, editor, *Jerry Renton*, associate editor, and *Vince Rider*, business manager. A phrase from y.t.'s mountaineering experiences comes to mind at this time—a well-wish in jest learned from some German climbers in the Sangre de Cristos, so to the new "bosses," "Hals und Beinbruch," and to all our loyal readers, simply so-long. . . .

M. M. B.

To create in steel the flowing lines of today's cars, calls for metal of particular forming qualities.

Sleek styling starts with special steel:

Photography turns chemist—helps produce it.

Fenders, hoods, roofs and side panels call for best quality steel—and the watchful eye of photography guards specifications and controls that quality.

Car designers' dreams come true only if steel forms well under the pressure of deep drawing operations. That takes a particularly high quality steel.

Great Lakes Steel Corporation, Detroit, Mich., unit of National Steel Corporation, makes this steel for the automobile industry. And to make sure of its high quality they use photography. For example, during production, spectrograms show chemical make-up—insure the proper minute quantities of alloying elements, and photomicrographs reveal crystalline structure.

Controlling quality is but one of the many ways photography works for modern industry. In small businesses and large it is aiding product design, simplifying production, creating sales and expediting office routine.

At Great Lakes Steel a spectrogram is readied for reading in the densitometer—one of the tests that assure quality steel.

Behind the many photographic products becoming increasingly valuable today and those being planned for tomorrow lie intriguing and challenging opportunities at Kodak in research, design and production.

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